



New York City Panel on Climate Change 4th Assessment Climate Risk and Equity: Advancing Knowledge Toward a Sustainable Future - Introduction

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Abstract

This Introduction to NPCC4 provides an overview of the first three NPCC Reports and contextualizes NPCC4’s deliberate decision to address justice, equity, diversity, and inclusion in its collective work with special attention on incorporating racial equity in its own practices, procedures, and methods of assessment. Next it summarizes the assessment process, including greater emphasis on sustained assessment. Finally, it introduces the NPCC4 chapters and their scope.

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1 Introduction

Climate change presents urgent, immediate, and long-term challenges to New York City (NYC). The New York City Panel on Climate Change (NPCC) was established in 2008 and codified in Local Law in 2012 to regularly assess the current state of the science on climate change and provide actionable policy-relevant recommendations for adaptation and resilience. This chapter introduces the 4th assessment report of the New York City Panel on Climate Change, NPCC4.

NPCC4 builds on groundbreaking climate assessment work at the state level (e.g., New York State Climate Impacts Assessment (New York State Energy Research and Development Authority, 2024)) and in the region, especially the Metro East Coast Study (C. Rosenzweig & Solecki, 2001) and the City's ongoing commitment to science-based policymaking informed by NPCC assessment reports associated with NPCC1 (C. Rosenzweig & Solecki, 2010), NPCC2 (C. Rosenzweig & Solecki, 2015), and NPCC3 (C. Rosenzweig & Solecki, 2019) as well as shorter special reports focused on climate risk information (C. Rosenzweig et al., 2009, 2013). NPCC4 includes new "*climate projections of record*" for NYC and grounds those climate futures in the social fabric of the city (Braneon et al., 2024). NPCC4 extends prior panels' commitment to equity, engagement, and transparency of processes across the assessment report.

The first NPCC Report introduced risk management frameworks for the city and region via flexible adaptation pathways. NPCC2 developed climate projections of record that were embedded in the City of New York resilience programs and regulations. NPCC3 introduced the concept of "co-generation" to the assessment process. NPCC4 builds on and deepens these innovations.

"The NPCC3 2019 Report co-generates new tools and methods for the next generation of Climate risk assessments and implementation of region-wide resilience. Co-generation is an interactive process by which stakeholders and scientists work together to produce climate change information that is targeted to decision-making needs. These tools and methods can be used to observe, project, and map climate extremes; monitor risks and responses; and engage with communities to develop effective programs. They are especially important at "transformation points" in the adaptation process when large changes in the structure and function of physical, ecological, and social systems of the city and region are undertaken" (C. Rosenzweig & Solecki, 2019)

2 A Dynamic Context

On December 19, 2019, the Mayor of New York appointed a group of five academics, researchers, and practitioners as co-chairs to lead the 4th New York City Panel on Climate Change. Providing expertise in climate science, engineering, social science, policy, design, and planning, the NPCC4 leadership team was convened with the ambition to support catalytic change during this next, and perhaps most crucial, decade of climate response in NYC. The co-chairs began meeting regularly with the Deputy Director for Climate Science and Risk Communication in the Mayor's Office of Resiliency¹, now the Mayor's Office of Climate and Environmental Justice (MOCEJ). Together, they established a set of goals for the assessment, including identifying near, intermediate, and long-term quantitative and qualitative climate trends; assessing potential impacts of climate change on the city's communities, vulnerable populations, public health, natural systems, critical infrastructure, and buildings; and expanding ways to use climate research to inform decision-making. From the outset, NPCC4 committed to strengthening participation by agencies and the public in the assessment process (see Section 4). The co-chairs and the Deputy Director then turned to identifying candidates to recommend to the Mayor to complete the full panel ensuring NPCC would meet its mandate to provide authoritative, actionable information on future climate change and its potential impacts in support of science-based decision-making by the City. However, between late December 2019 and June 2020, when the full panel was charged by the Mayor, the novel SARS-CoV-2/COVID-19 pandemic emerged in full and, in a trauma that would lay bare the modern brutality of structural racism in the United States, George Floyd's murder in police custody was filmed in a live-streamed video that quickly spread worldwide. Other systemic shocks would follow, including an

¹ The key office for coordination with NPCC was the Mayor's Office of Resiliency (MOR), which then became the Mayor's Office of Climate Resiliency (MOCR) in April 2021, and then the Mayor's Office of Climate and Environmental Justice (MOCEJ) around January 2022. Adam Parris was the Deputy Director for Climate Science and Risk Communication in that office when NPCC4 was empaneled. Emilie Schnarr, Victoria Cerullo, and Hayley Elasz subsequently held that or a similar post and acted as a key partner with the co-chairs in the 4th Assessment.



extreme rainfall and flooding event associated with the remnants of Hurricane Ida and the 13 deaths in NYC (and more than 45 deaths in the New York metropolitan region) that lay in its wake. As events continued to confirm that the context of the 4th assessment was shifting in real-time, the full panel went to work assuring NPCC4 would produce a report in support of the City's initiatives to build resilience and equity into climate adaptation.

The profound system-level shock of COVID-19 revealed additional challenges to the City's resilience that will likely be exacerbated by current and future climate change. Climate change, like COVID-19, demands the full attention and commitment of the city government and the cooperation of local, state, federal, and global government, NGO, and private entities alike. Layering the impacts of significant, and likely, climate related system-level perturbations such as a hurricane or a sustained heat wave that threatens electrical grid capacity on top of a public health crisis, multiplies the complexity of the management challenge in the acute moment of impact, and complicates the long-term economic and ecological recovery. Advanced planning, dynamic and sustained adaptation, environmental and climate justice, as well as a commitment to ongoing assessment that reflects the state of emerging science are the hallmarks of a resilient city and the bedrock commitment of the NPCC.

Incorporating lessons from the SARS-CoV-2/COVID-19 pandemic is consistent with the NPCC's mandate. Projected increases in the frequency and intensity of extreme events pose particular challenges to NYC in the short-term and over the course of the 21st century. Public health (and other) emergencies intersect with and amplify climate-related health impacts. Current data indicate that NYC neighborhoods that had the highest rates of positive COVID-19 cases also have higher proportions of service workers, rent-burdened households, and people of color (Do & Frank, 2021; Friedman & Lee, 2021; Marcotullio & Solecki, 2021; Mustafa et al., 2021; Ortiz et al., 2022).

NPCC3 concluded that there is a need for further investigation into optimal methods to track social vulnerability to climate change and resilience at the community scale (Foster et al., 2019). In addition, the report concluded that illustrative indicators of energy sector transmission and distribution under extreme heat and humidity are needed. Furthermore, the report highlighted the critical importance of including attention to equity in all phases of climate adaptation efforts. In response, NPCC4 has incorporated equity considerations to a greater extent across all chapters.

The altered context of climate hazards assessed in NPCC4 is not limited to the uneven geography of race and health. At the municipal, state, and national level, a rapidly changing policy environment including the recently released PlaNYC, LL97 of 2019, changes to NYC coastal zoning, the New York State Climate Impact Assessment, Justice40, the Inflation Reduction Act of 2022, and Infrastructure Investment and Jobs Act, to name only a few, demonstrate the unique opportunity amid the urgency of the climate crisis that NPCC4 seeks to highlight. In addition, the City of New York commissioned new Climate Vulnerability, Impact, and Adaptation Analysis (VIA) research (McPhearson et al., 2024) that has provided new information on biophysical climate and flooding science, the economic impacts on health from climate change, and the social-spatial geography of flood vulnerability. Much of the VIA work has been incorporated in NPCC4.

What follows in this report is an assessment that offers policymakers, stakeholders, and communities a framework for centering equity, building flexible adaptation pathways, and incorporating sustained assessment processes that continue to evaluate and improve adaptation and mitigation of climate change.

The workgroups in NPCC4 were responsive to this dynamic environment. The groups were formed based on meetings and input from city agencies about key and emerging climate risks for the city and on the expertise and capacities of the panel. Initially six workgroups were formed focusing on topics including flooding, health, equity, futures and transitions, climate science, and shared methods (see Figure 1). Climate science has been the backbone of all NPCC assessments including NPCC4. Health and Equity workgroups were introduced in NPCC2 and NPCC3, respectively. While tracing their origins to points of emphasis in prior NPCC assessments, the Flooding, Futures and Transitions, and Shared Methods workgroups represent new directions for the Panel in NPCC4. The workgroups were each led by two co-chairs and included panel members as well as external participants.

Figure 1, showing a hand-drawn visual recording of a NPCC4 all-hands meeting in June 2021, reveals early aspirations for the content scoping of the workgroups. Over the course of the Assessment, these workgroups expanded to involve additional experts, met regularly, to define and write chapter(s), and to obtain input and feedback from a variety of stakeholders (see Section 4 below). Workgroups were designed to be cross-fertilized so that some panel members would participate in multiple groups. This approach fostered connections between workgroups and allowed for the fluid development of content. For example, the role of energy poverty on health and well-being was a clear focus of the health workgroup (see Figure 1); yet as aspects of the energy transitions were also developed in the Futures & Transition workgroup, it became evident that Energy and Energy Insecurity would be best addressed in a separate chapter. As Figure 2 makes clear, NPCC4 aimed to center equity throughout the work of the Assessment

from its earliest stages. Figure 2 (reflecting NPCC4’s kick-off meeting) also centers Co-Production of the Assessment with MOR (now MOCEJ). NPCC4 created hand-drawn visual recordings to document and reflect on the diversity of perspectives at various early meetings when the work of the full panel was getting underway. These drawings were produced in real-time during the meetings and redrawn upon reflection to capture and distill the key concepts, comments, people, and conclusions from each gathering. As participation in these meetings was entirely virtual, the note taking as shown in Figure 2 shows the active exchanges that occurred through chat (noted by the rectangular call-out boxes shown in the margins) as a feature of these meetings.

In addition to this introduction and a concluding chapter, these efforts have resulted in six substantive chapters in this 4th Assessment (See Section 5) along with the *NYC Climate Risk Information 2022: Observations and Projections* (Braneon et al., 2024), in addition to plain-language summaries that highlight the Assessment’s key findings.

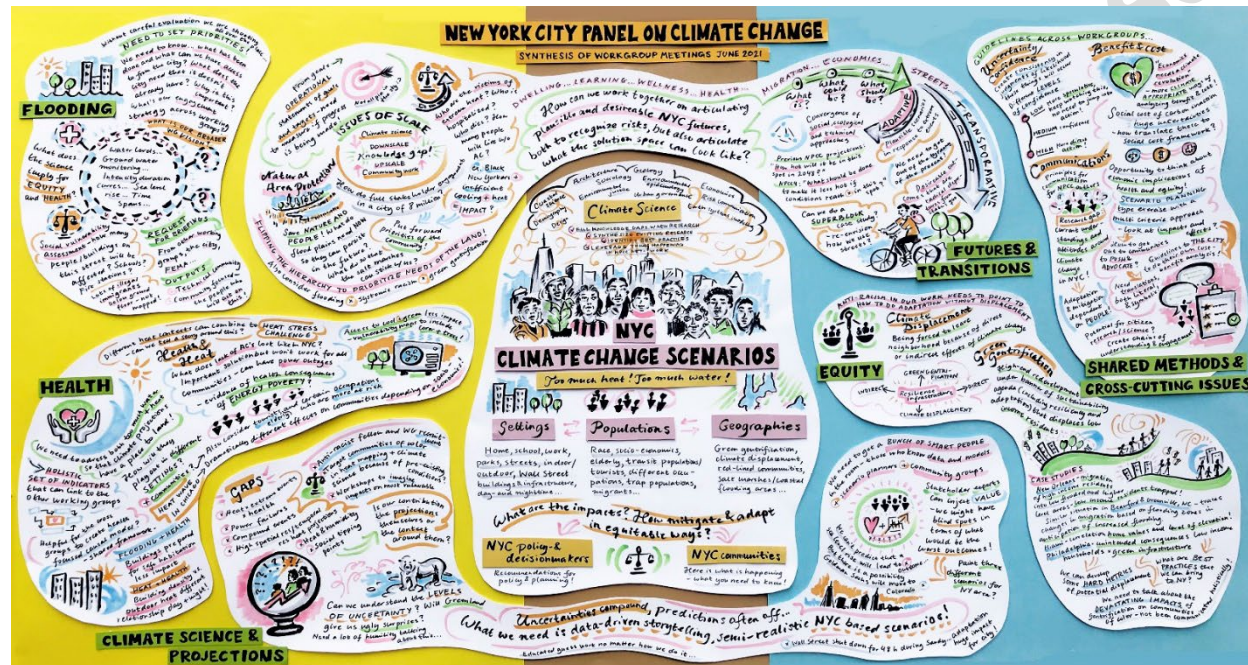


Figure 1. Johanna Tysk. Visual Notes from NPCC4 All Hands Meeting, June 2021

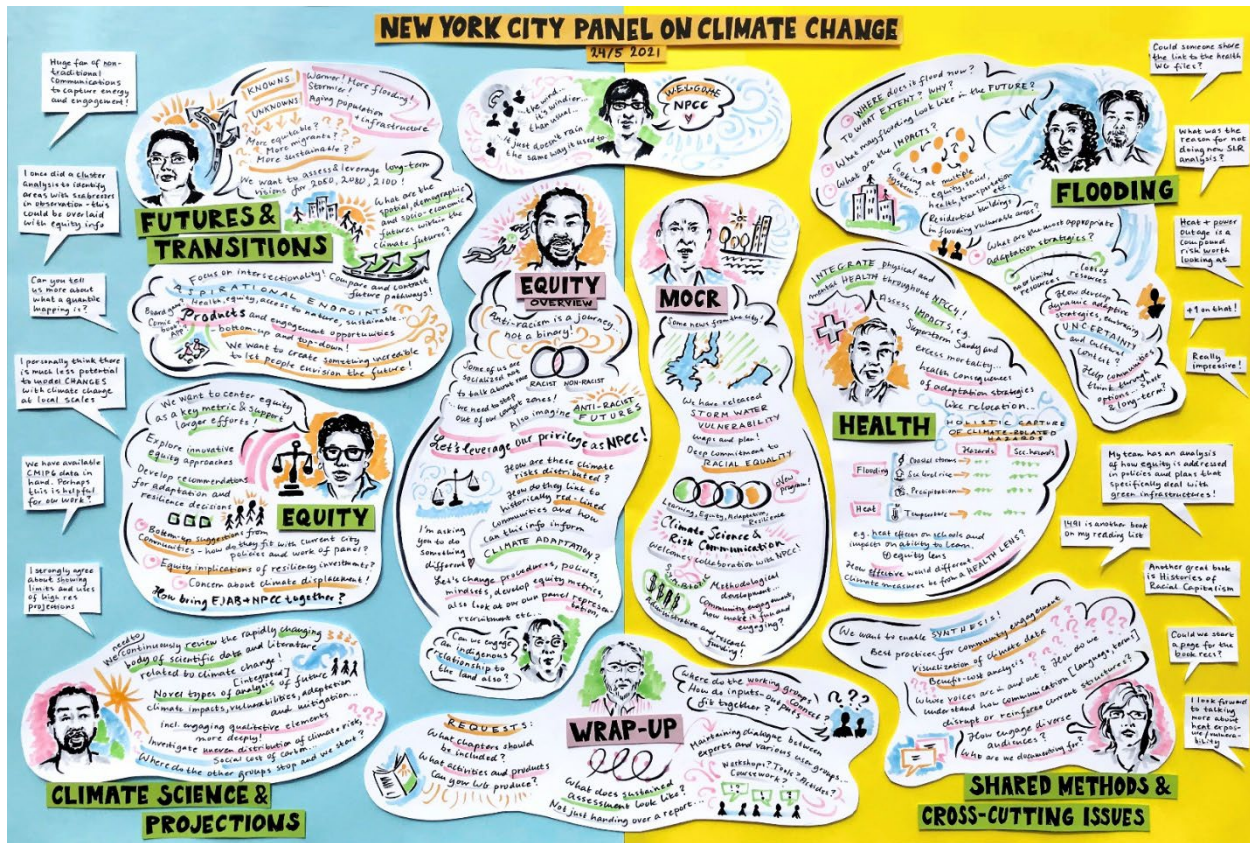


Figure 2. Johanna Tysk. Visual Notes from NPCC4 Kick-off Meeting, May 2021.

3 Centering Equity

The NPCC brings expertise in climate science, engineering, architecture, social science, public health, policy, design, and planning to the work of the 4th Assessment. Efforts to center equity in NPCC4 began with the panel's formation. The full NPCC, with 20 members when seated in the spring of 2020, was more diverse than prior panels, in terms of gender, age, career stage, and racial and ethnic composition. Full membership, with the inclusion of additional external members (researchers, students, practitioners) to the workgroups, is even more diverse. Notably, this panel offers a much wider range of disciplinary expertise than prior panels – including climate scientists, geographers, demographers, economists, health experts, architects, ecologists, and planners among others – from which new framings for the work of the assessment, including centering the assessment on equity, can emerge.

NPCC3 (2019) produced the first NPCC assessment report to devote a chapter of the report to questions surrounding equity in community vulnerability and adaptation (Foster et al., 2019). These efforts, which included development of a framework for incorporation of equity into the city's climate adaptation planning efforts, were co-produced through collaboration between NPCC panel members, representatives from community-based environmental justice groups, and representatives from the City (Foster et al., 2019; Leichenko et al., 2023). Building upon NPCC3, NPCC4 incorporates consideration of the equity implications of climate change adaptation in every chapter of the report.

NPCC4 also made a deliberate decision to address justice, equity, diversity, and inclusion in its collective work with special attention on incorporating racial equity in its own practices, procedures, and methods of assessment. To this end, each NPCC4 working group completed an interim report outlining the status of their work as it related to racial equity in the fall of 2022. Further, most panel members participated in a two-part racial equity training session (See

Figure 3) that was developed and led by BlackSpace Urbanist Collective, Inc.² (<https://blackspace.org/>) in partnership with Luis Alejandro Tapia (<https://www.louknows.com/>).

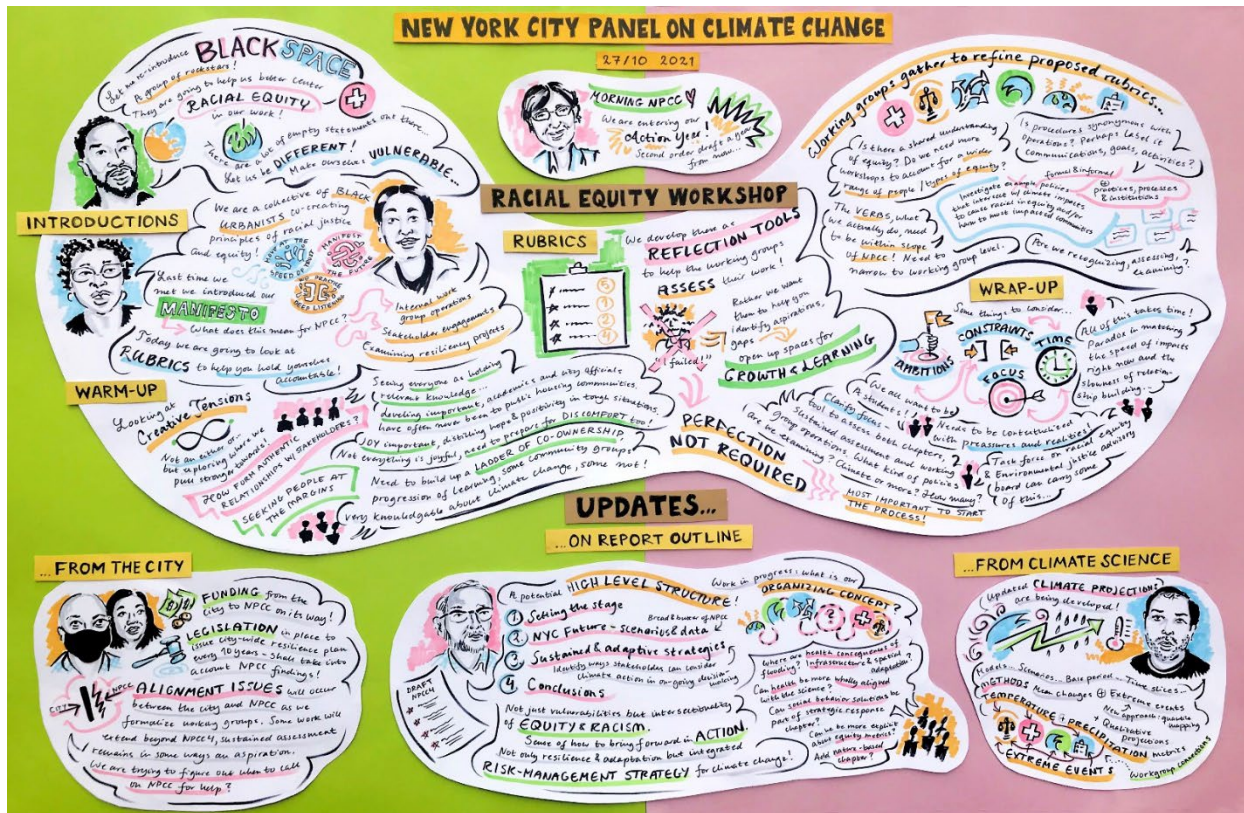


Figure 3. Johanna Tysk. Visual Notes from NPCC4 from Racial Equity Workshop and All-Hands Meeting, October 2021.

The training sessions included panel members along with members of the City’s Environmental Justice Advisory Board (EJAB). The work included development of specific commitments to incorporate racial equity in workgroup operations and activities, and development of a rubric for assessment of each workgroup’s equity efforts. This rubric was used internally by each workgroup, first in 2022 to assess its practices and early chapter development efforts, and again in 2023 to assess its first order draft. The rubric entailed qualitative and quantitative assessment of the workgroup’s incorporation of equity³ into its internal processes and procedures, impact and policy analysis, and recommendations. The rubric draws from the work of Ibram X. Kendi (2019) as well as insights and suggestions from the BlackSpace team. The following topics were included in the rubric:

- Integration of equity and antiracism into internal processes and procedures.
- Acknowledgement of racial inequity as a problem of racist structures (including but not limited to historic and current policy, regulations, procedures, norms, and institutions); not just people with racist views.
- Reference to data and literature from racially and gender diverse sources, taking into consideration alternative forms of knowledge (i.e., Indigenous knowledge, storytelling, experiential knowledge).
- Identification of how climate impacts and policies intersect with racial inequity in any of its manifestations.

² BlackSpace Urbanist Collective, Inc. is an interdisciplinary collective of Black urbanists committed to acknowledging, affirming, and amplifying Black presence in the built environment.

³ Antiracism is a powerful collection of antiracist policies that lead to racial equity and are substantiated by antiracist ideas. An antiracist idea is any idea that suggests the racial groups are equals in their apparent differences—that there is nothing right or wrong with any racial group. Antiracist ideas argue that racist policies are the cause of racial inequities (Kendi, 2019).



- Investigation of policies, structures, and institutions causing racial inequity that intersect with climate impacts.
- Identification or creation of antiracist climate measures/strategies that aim to reduce and ideally eliminate racial inequity.
- Recommendation of strategies to monitor the impacts that antiracist climate measures/strategies have on reducing and eliminating racial inequity.
- Recommendation of strategies to support new antiracist climate actions and policies (and prevent actions and policies that reinforce racial inequity).
- Use of bias-free language and visuals that are culturally and racially sensitive (i.e., all appropriate groups are represented, visuals reflect lived experiences), providing definitions and clarification when necessary.

The internal assessment was facilitated by an NPCC intern, Georgia Grzywacz, who also provided feedback to each workgroup based on her interaction with the group and her review of the first order chapter drafts. This process was designed to be inward-facing for each workgroup in order to provide opportunities to reflect on its equity-focus efforts and to adjust practices, processes, and assessment work as needed.

4 Elements of the Assessment Process

Transparency and accountability, along with scientific rigor, are cornerstones of any sustained assessment process. Thus, to guide the work of the panel, the co-chairs created a “Principles and Processes” document that was shared with all panel members (see BOX 1), edited by the full panel, and endorsed by all persons working on NPCC4. Sustained assessment refers to an ongoing process that engages researchers, professional practitioners, and stakeholders to share and apply knowledge and experience relevant to adaptation and mitigation solutions (Buizer et al., 2016; Moss et al., 2019). The concept was applied at the national scale in the third U.S. National Climate Assessment (NCA) (Hall et al., 2014; Melillo et al., 2014) as an approach to improve assessment outcomes and address expanding needs for decision-relevant information. Sustained dialogue with users is needed to identify information needs and decision contexts, establish useful communications formats, diversify products and communications, and build capacity to use available science and technical information in taking action. It has the potential to promote collaborative learning and establish leading practices (i.e., professional standards) for climate risk management strategies so that available knowledge is tailored for specific environmental, socioeconomic, and cultural contexts.



BOX 1. NPCC4 Principles and Processes

In general, the products and activities of the Panel will analyze and present the knowledge necessary for decision making and implementation of climate change policies and actions. The Panel's products will inform New York City's efforts to address the climate crisis. They will identify key gaps in climate knowledge and research needs relevant to these efforts. In addition, the Panel seeks to enhance accountability for translation of climate knowledge to action through effective engagement and communication on climate-related issues with a range of audiences. Some of the key principles and processes for the 4th cycle of the Panel's work are described below.

Deliberation and use of information:

- NPCC4 will operate in a transparent, accountable, and rigorous fashion. This includes transparency in its public meetings and decision-making processes.
- Adoption of the Panel's work plan, approval of reports and summaries for public release, and other major decisions will be made by consensus of the Panel. Members are expected to work towards consensus in good faith, but if during the process of approving reports and other materials consensus cannot be reached, dissenting opinions may be noted.
- The Co-Chairs may make decisions on behalf of the Panel for routine procedural matters or when more rapid decisions are needed in between Panel meetings. The Co-Chairs commit to the rest of the Panel to consult with them on any major issues that could call into question Panel members' roles or judgment.
- The NPCC will address justice, equity, diversity, and inclusion in its work. This commitment extends to bringing to light how systemic racism and injustice intensify the impacts of climate change and how anti-racist policies can be integrated into climate action to promote a just, resilient, sustainable, and more vibrant future.

Traceable accounts:

- NPCC will strive to make its products accessible and useful to decision-makers and the general public. It will engage with the intended audiences and users of Panel products, adopting a "co-production" or "sustained assessment" approach to its work. This approach will facilitate the relevance, credibility, and legitimacy of Panel products and activities.
- The Panel will reach its conclusions collectively. Individual panel members do not speak "for the NPCC" except when they represent agreed findings or decisions.
- NPCC4 will adopt a consistent framework and process for assessing and reporting on levels of confidence and significant sources of uncertainty. This will facilitate effective communication with users.
- The Panel will rely on published, peer-reviewed sources of information whenever possible. However, the Panel recognizes that invaluable information relevant to its work may come from non-peer reviewed sources. NPCC4 will use standards on information quality and transparency to provide open-source documentation of all data used in its products.

An important component of sustained assessment is co-production. Much of NPCC4's success has been predicated on embracing a co-production approach (see Box 2)— that is, by engagement between members of the panel and many stakeholders in local agencies from city government to other public and private organizations (Foster et al., 2019; C. Rosenzweig et al., 2011; C. Rosenzweig & Solecki, 2019). Co-produced climate assessments are increasingly recognized as a means of improving the effective generation and utilization of climate information to inform decision-making and support adaptation to climate change. However, as scholars and practitioners have illustrated, co-production does present potential pitfalls (e.g., transactional costs) for scientists, decision-makers, and community members (Cvitanovic et al., 2019; Lemos et al., 2018). NPCC has weathered these potential pitfalls and, as the appointment of NPCC4 suggests, co-production remains a cornerstone of the City's climate response.

NPCC outlined a framework for co-production and partnership between the City of New York, principally the Mayor's Office of Resiliency (now MOCEJ), and NPCC specifically for the 4th assessment cycle of NPCC (i.e., NPCC4). The actions outlined in BOX 2 were intended to allow for an agile and authoritative process (and are not listed in order of priority or emphasis).



BOX 2. Co-Production: Actions and Accountability

Action	Description
Action 1	Form an Executive Committee including leadership from MOR and NPCC.
Action 2	Facilitate coordination between NPCC, the Climate Change Adaptation Task Force (CCATF), and the Environmental Justice Advisory Board (EJAB), including potentially a joint working group or committee.
Action 3	Form a Fundraising Committee for NPCC with joint leadership from MOR and NPCC.
Action 4	Develop scenario planning and climate knowledge briefs as collaborative projects between MOR, NPCC, and partners.
Action 5	Create an MOR-NPCC Fellows Program.

Progress was made on all five actions, to varying degrees.

Actions 1, 4 and 5 were fully implemented for NPCC4, and future NPCC assessments may choose to maintain and build on those efforts. For example, the MOR-NPCC Fellows Program (City of New York Mayor’s Office of Resiliency, 2021) (Action 5) was responsive to the City’s current internship programs (i.e., that they must be paid or receiving academic credit) and, consistent with Action 3, may need future resourcing to meet NPCC’s inclusivity objectives.

Because panel members of NPCC, like IPCC and NCA, work on a volunteer basis, the issue of resourcing the assessment (both administratively and substantively) -- that is, Action 3 -- was identified as an important area to be developed. NPCC4 made important progress on Action 3 via resource allocation that was essential to its mandate. Funding for report administration, support, and production was allocated by NYC. Although these funds were identified late in the process (almost three years after the panel was seated) the final report critically relied on the support from the administrative contract after a competitive Request for Proposals (RFP) process.

In addition, as noted above, NYC commissioned new Climate Vulnerability, Impact, and Adaptation Analysis (VIA) research during the timeframe of NPCC4 through an open RFP process. Though not predicated on NPCC, the City’s commitment to original research significantly advanced NPCC4 and future panels.

As for Action 2, NPCC4 met with CCATF virtually in November 2021. With about 150 persons representing government and quasi-government agencies, this was the only meeting organized by MOCR/MOCEJ between CCATF and NPCC4. There were no further engagements with CCATF because it has not been convened since 2021. Because the City valued multiple touchpoints with NPCC, it developed a broad Interagency Climate Assessment Team (ICAT) -- comprising about 16 individuals representing 8 agencies -- to foster engagement with city agencies and the NPCC workgroups.

These actions established principles for NPCC4 to ensure an iterative and meaningful stakeholder engagement for shared learning and collaboration – that is, co-production and sustained assessment activities (Lemos & Morehouse, 2005; Meadow et al., 2015; Vincent et al., 2018) -- in order to align its work with just and resilient climate action.

To ensure access and uptake to NPCC4 products, NPCC has produced a website [<https://climateassessment.nyc>] with access to data, plan-language summaries for each chapter, and a variety of other climate-change related resources.

Co-production in the NPCC4 occurred at the level of the Panel’s workgroups in several ways. In some cases, the workgroups identified ongoing consultations and efforts that engaged communities, relevant professionals, and scientists to discuss future hazards, their impacts, and what can be done to prepare (e.g., OneNYC2050 and NYC Adaptation Scenarios 2100 (Cook et al., 2022)). While gaps and challenges remain, these engagements offered an opportunity for building out more effective dialogue about future climate action in the city. In other cases, the workgroups reviewed information needs identified through the Climate Knowledge Exchange 2021 report (City of New York, 2022) and offered suggestions for the City to convene communities of practice to dive deeper and develop required information. And in some cases, the workgroups convened public meetings focused on issues of concern (e.g., stormwater management or displacement) identified in their chapters. While resources available to the NPCC were not sufficient to convene and sustain these processes, these discussions provide ideas for the future,



particularly for sustained assessment and ongoing collaborations. The Climate Knowledge Exchange (2024) continues to provide a forum for sharing scientific climate information, receiving input from diverse stakeholders, and co-producing climate research priorities. Finally, all chapters engaged with relevant members of ICAT (See Box 2) in the drafting process of their chapters.

5 Organization of NPCC4 Assessment Report

The 4th Assessment is divided into the following six chapters, in addition to this Introduction, a Conclusion with recommendations for next steps, and the Climate Science Special Report (Braneon et al., 2024):

1. Tail Risk, Climate Drivers of Extreme Heat, and New Methods for Extreme Event Projections | (Ortiz et al., 2024)
2. Climate Change and New York City's Flood Risk | (B. Rosenzweig et al., 2024)
3. Advancing Climate Justice in Climate Adaptation Strategies for New York City | (Foster et al., 2024)
4. Climate Change and New York City's Health Risk | (Matte et al., 2024)
5. Climate Change, Energy, and Energy Insecurity in New York City | (Yoon et al., 2024)
6. Concepts and Tools for Envisioning New York City's Futures | (Balk et al., 2024)

Ortiz et al. (2024) document recent observed climate trends and confirm new temperature and precipitation projections of record for NYC; new sea level rise projections of record are confirmed in Braneon et al. (2024). Foster et al. (2024) build on the findings and recommendations to the City from the NPCC3 equity workgroup to identify additional metrics and adaptation efforts that can advance climate justice. Rosenzweig et al. (2024) provide a comprehensive description of the different types of flood hazards facing NYC and provide climatological context that can be utilized, along with climate change projections, to support flood risk management (FRM). Balk et al. (2024) synthesize the state of knowledge on social-demographic, economic, transportation, housing, health futures, and many other subsystems of the complex system of NYC that will all interact to determine the City's futures. Matte et al. (2024) update evidence since the last NPCC health assessment in 2015 as part of NPCC2 (Kinney et al., 2015) and address climate health risks as well as vulnerabilities with an emphasis on heat and flooding. Yoon et al. (2024) provide an overview of energy trends in NYC and the State, considers challenges and barriers in energy transition, and implications for energy insecurity, which can have profound and inequitable impacts on human health and wellbeing. Through this collection of technical reports (e.g. Balk et al. (2024), Braneon et al. (2024), Foster et al. (2024), Matte et al. (2024), Ortiz et al. (2024), and Yoon et al. (2024)), NPCC4 continues its mandate of providing NYC with essential climate information while centering that knowledge in the dynamic socio-ecological environment of today.



6 References

- Balk, D., McPhearson, T., Cook, E. M., Knowlton, K., Maher, N., Marcotullio, P., Matte, T. D., Moss, R., Ortiz, L. E., Towers, J., Ventrella, J., & Wagner, G. (2024). NPCC4: Concepts and Tools for Envisioning New York City's Futures (pre-publication draft). *Annals of New York Academy of Sciences*.
- Boeckmann, M., & Zeeb, H. (2016). Justice and Equity Implications of Climate Change Adaptation: A Theoretical Evaluation Framework. *Healthcare*, 4(3), 65. <https://doi.org/10.3390/healthcare4030065>
- Braneon, C., Ortiz, L., Bader, D., Devineni, N., Orton, P., Rosenzweig, B., McPhearson, T., Smalls-Mantey, L., Gornitz, V., Mayo, T., Kadam, S., Sheerazi, H., Glenn, E., Yoon, L., Derras-Chouk, A., Towers, J., Leichenko, R., Balk, D., Marcotullio, P., & Horton, R. (2024). NPCC4: NYC Climate Risk Information 2022: Observations and Projections (pre-publication draft). *Annals of the New York Academy of Sciences*.
- Buizer, J. L., Dow, K., Black, M. E., Jacobs, K. L., Waple, A., Moss, R. H., Moser, S., Luers, A., Gustafson, D. I., Richmond, T. C., Hays, S. L., & Field, C. B. (2016). Building a sustained climate assessment process. *Climatic Change*, 135(1), 23–37. <https://doi.org/10.1007/s10584-015-1501-4>
- City of New York. (2022). *State of Climate Knowledge 2022: Workshop Summary Report* (Climate Knowledge Exchange). City of New York Mayor's Office of Climate and Environmental Justice. https://climate.cityofnewyork.us/wp-content/uploads/2022/04/2022_CKE_Report_10.25.22.pdf
- Climate Knowledge Exchange. (2024). NYC Mayor's Office of Climate and Environmental Justice. <https://climate.cityofnewyork.us/initiatives/climate-knowledge-exchange/>
- Cook, E., Ventrella, J., McPhearson, T., Parris, A., Tier, M., Muñoz-Erickson, T., Iwaniec, D., Mannetti, L., Green, C., & Tagtachian, D. (2022). *New York City Climate Adaptation Scenarios for 2100: Exploring Alternative, Positive Visions for a Resilient Future*. Urban Systems Lab. The New School. <https://urbansystemslab.com/nycadaptationfutures>
- Cvitanovic, C., Howden, M., Colvin, R. M., Norström, A., Meadow, A. M., & Addison, P. F. E. (2019). Maximising the benefits of participatory climate adaptation research by understanding and managing the associated challenges and risks. *Environmental Science & Policy*, 94, 20–31. <https://doi.org/10.1016/j.envsci.2018.12.028>
- Do, D. P., & Frank, R. (2021). Unequal burdens: Assessing the determinants of elevated COVID-19 case and death rates in New York City's racial/ethnic minority neighbourhoods. *Journal of Epidemiology and Community Health*, 75(4), 321–326. <https://doi.org/10.1136/jech-2020-215280>
- Foster, S., Baptista, A., Nguyen, K. H., Tchen, J., Tedesco, M., & Leichenko, R. (2024). NPCC4: Advancing Climate Justice in Climate Adaptation Strategies for New York City (pre-publication draft). *Annals of the New York Academy of Sciences*.
- Foster, S., Leichenko, R., Nguyen, K. H., Blake, R., Kunreuther, H., Madajewicz, M., Petkova, E. P., Zimmerman, R., Corbin-Mark, C., Yeampierre, E., Tovar, A., Herrera, C., & Ravenborg, D. (2019). New York City Panel on Climate Change 2019 Report Chapter 6: Community-Based Assessments of Adaptation and Equity. *Annals of the New York Academy of Sciences*, 1439(1), 126–173. <https://doi.org/10.1111/nyas.14009>
- Friedman, S., & Lee, J.-W. (2021). COVID-19 MORTALITY IN NEW YORK CITY ACROSS NEIGHBORHOODS BY RACE, ETHNICITY, AND NATIVITY STATUS. *Geographical Review*, 111(4), 571–591. <https://doi.org/10.1080/00167428.2021.1951118>
- Hall, J. A., Blair, M., Buizer, J. L., Gustafson, D. I., Holland, B., Moser, S. C., & Waple, A. M. (2014). Ch. 30: *Sustained Assessment: A New Vision for Future U.S. Assessments*. *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program. <https://doi.org/10.7930/J000001G>
- Kendi, I. X. (2019). *How to be an antiracist* (First Edition). One World.
- Kinney, P. L., Matte, T., Knowlton, K., Madrigano, J., Petkova, E., Weinberger, K., Quinn, A., Arend, M., & Pullen, J. (2015). New York City Panel on Climate Change 2015 Report Chapter 5: Public Health Impacts and Resiliency. *Annals of the New York Academy of Sciences*, 1336(1), 67–88. <https://doi.org/10.1111/nyas.12588>
- Leichenko, R., Foster, S., & Nguyen, K. (2023). *Bringing Equity into Climate Change Adaptation Planning* (J. Rice, J. Long, & A. Levenda, Eds.; Urban Climate Justice: Theory, Praxis, and Resistance). University of Georgia Press. <https://ugapress.org/book/9780820363769/urban-climate-justice>



- Lemos, M. C., Arnott, J. C., Ardoin, N. M., Baja, K., Bednarek, A. T., Dewulf, A., Fieseler, C., Goodrich, K. A., Jagannathan, K., Klenk, N., Mach, K. J., Meadow, A. M., Meyer, R., Moss, R., Nichols, L., Sjoström, K. D., Stults, M., Turnhout, E., Vaughan, C., ... Wyborn, C. (2018). To co-produce or not to co-produce. *Nature Sustainability*, 1(12), 722–724. <https://doi.org/10.1038/s41893-018-0191-0>
- Marcotullio, P., & Solecki, W. D. (2021). COVID-19 as an Extreme Event in the New York Metropolitan Region. *Journal of Extreme Events*, 08(02), 2102001. <https://doi.org/10.1142/S2345737621020012>
- Matte, T. D., Lane, K., Tipaldo, J., Barnes, J., Knowlton, K., Torem, E., Anand, G., Yoon, L., Marcotullio, P. J., Balk, D., Constible, J., Elszasz, H., Ito, K., Jessel, S., Limaye, V. S., Parks, R. M., Rutigliano, M., Sorenson, C., & Yuan, A. (2024). NPCC4: Climate Change and New York City's Health Risk (pre-publication draft). *Annals of New York Academy of Sciences*.
- McPhearson, T., Towers, J., Rosenzweig, B. R., & Knowlton, K. (2024). *Climate Vulnerability, Impact, and Adaptation Analysis (VIA) (in preparation)*. NYC Mayor's Office of Climate and Environmental Justice. <https://climate.cityofnewyork.us/initiatives/vulnerability-impacts-and-adaptation-analysis/>
- Melillo, J. M., Richmond, T. (T. C.), & Yohe, G. W. (2014). *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program. <https://doi.org/10.7930/J0Z31WJ2>
- Moss, R. H., Avery, S., Baja, K., Burkett, M., Chischilly, A. M., Dell, J., Fleming, P. A., Geil, K., Jacobs, K., Jones, A., Knowlton, K., Koh, J., Lemos, M. C., Melillo, J., Pandya, R., Richmond, T. C., Scarlett, L., Snyder, J., Stults, M., ... Zimmerman, R. (2019). Evaluating Knowledge to Support Climate Action: A Framework for Sustained Assessment. Report of an Independent Advisory Committee on Applied Climate Assessment. *Weather, Climate, and Society*, 11(3), 465–487. <https://doi.org/10.1175/WCAS-D-18-0134.1>
- Mustafa, A., Ebaid, A., Omrani, H., & McPhearson, T. (2021). A multi-objective Markov Chain Monte Carlo cellular automata model: Simulating multi-density urban expansion in NYC. *Computers, Environment and Urban Systems*, 87, 101602. <https://doi.org/10.1016/j.compenvurbsys.2021.101602>
- New York State Energy Research and Development Authority. (2024). *New York State Climate Impacts Assessment: Understanding and Preparing for Our Changing Climate*. New York State Climate Impacts Assessment. <https://nysclimateimpacts.org/>
- Ortiz, L., Braneon, C. V., Horton, R., Bader, D., Orton, P. M., Gornitz, V., Rosenzweig, B. R., McPhearson, T., Smalls-Mantey, L., Sheerazi, H., Montalto, F. A., Goldhandan, M. R., Evans, C., DeGaetano, A. T., Mallen, E., Carter, L., McConnell, K., & Mayo, T. L. (2024). NPCC4: Tail Risk, Climate Drivers of Extreme Heat, and New Methods for Extreme Event Projections (pre-publication draft). *Annals of New York Academy of Sciences*.
- Ortiz, L., Mustafa, A., Cantis, P. H., & McPhearson, T. (2022). Overlapping heat and COVID-19 risk in New York City. *Urban Climate*, 41, 101081. <https://doi.org/10.1016/j.uclim.2021.101081>
- Rosenzweig, B., Montalto, F. A., Orton, P. M., Kaatz, J., Maher, N., Masterson, K., Busciolano, R., Kleyman, J., Chen, Z., Sanderson, E., Adhikari, N., McPhearson, T., & Herrerros-Cantis, P. (2024). NPCC4: Climate Change and New York City's Flood Risk (pre-publication draft). *Annals of New York Academy of Sciences*.
- Rosenzweig, C., & Solecki, W. (2010). Introduction to *Climate Change Adaptation in New York City: Building a Risk Management Response*. *Annals of the New York Academy of Sciences*, 1196(1), 13–18. <https://doi.org/10.1111/j.1749-6632.2009.05306.x>
- Rosenzweig, C., & Solecki, W. (2015). New York City Panel on Climate Change 2015 Report Introduction. *Annals of the New York Academy of Sciences*, 1336(1), 3–5. <https://doi.org/10.1111/nyas.12625>
- Rosenzweig, C., & Solecki, W. (2019). New York City Panel on Climate Change 2019 Report Chapter 1: Introduction. *Annals of the New York Academy of Sciences*, 1439(1), 22–29. <https://doi.org/10.1111/nyas.14004>
- Rosenzweig, C., Solecki, W., College, H., Blake, R., Bowman, M., Gornitz, V., Jacob, K., Kinney, P., Kunreuther, H., Kushnir, Y., Leichenko, R., Lin, N., Nordenson, G., Oppenheimer, M., Yohe, G., Horton, R., Lead, C., Patrick, L., Bader, D., & Ali, S. (2013). *New York City Panel on Climate Change—Climate Risk Information 2013: Observations, Climate Change Projections, and Maps* (PlaNYC). City of New York.
- Rosenzweig, C., & Solecki, W. D. (2001). *Climate Change and a Global City: The Potential Consequences of Climate Variability and Change—Metro East Coast. Report for the U.S. Global Change Research Program, National Assessment of the Potential Consequences of Climate Variability and Change for the United States* (ro00600k). Columbia Earth Institute, Columbia University.
- Rosenzweig, C., Solecki, W. D., Blake, R., Bowman, M., Faris, C., Gornitz, V., Horton, R., Jacob, K., LeBlanc, A., Leichenko, R., Linkin, M., Major, D., O'Grady, M., Patrick, L., Sussman, E., Yohe, G., & Zimmerman, R.



(2011). Developing coastal adaptation to climate change in the New York City infrastructure-shed: Process, approach, tools, and strategies. *Climatic Change*, 106(1), 93–127. <https://doi.org/10.1007/s10584-010-0002-8>

Rosenzweig, C., Solecki, W. D., Parshall, L., Lynn, B., Cox, J., Goldberg, R., Hodges, S., Gaffin, S., Slosberg, R. B., & Savio, P. (2009). Mitigating New York City's heat island: Integrating stakeholder perspectives and scientific evaluation. *Bulletin of the American Meteorological Society*, 90(9), 1297–1312.

Yoon, L., Ventrella, J., Marcotullio, P., Matte, T., Lane, K., Tiplado, J., Jessel, S., Schmid, K., Casagrande, J., & Elszasz, H. (2024). NPCC4: Climate Change, Energy, and Energy Insecurity in New York City (pre-publication draft). *Annals of New York Academy of Sciences*.

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